

CONTENTS

PLAN SUMMARY	1
ACRONYMS/ABBREVIATIONS USED	ix
GLOSSARY	xi
1 INTRODUCTION	1-1
1.1 CONTEXT OF PLAN DEVELOPMENT	1-1
1.2 PURPOSE OF PLAN	1-2
1.3 ESA REQUIREMENTS	1-3
1.4 RECOVERY GOALS	1-3
1.5 ORGANIZATION OF RECOVERY PLANNING	1-4
1.5.1 Technical Recovery Teams	1-4
1.5.2 Lake Ozette Sockeye Steering Committee	1-5
1.6 TRIBAL TRUST AND TREATY RESPONSIBILITIES	1-7
1.7 OLYMPIC NATIONAL PARK	1-9
2 BACKGROUND AND CURRENT STATUS	2-1
2.1 WATERSHED DESCRIPTION	2-1
2.2 SOCKEYE SALMON (General Overview)	2-5
2.3 LAKE OZETTE SOCKEYE SALMON ESU	2-7
2.4 LAKE HYDROLOGY	2-12
2.5 SPAWNING HABITAT	2-13
2.6 OZETTE WATERSHED LAND USE	2-15
2.6.1 Historical Settlement	2-15
2.6.2 Modern Land Ownership and Land Use	2-16
2.6.2.1 Olympic National Park	2-19
2.6.2.2 Timber Harvest and Forest Practices	2-19
2.6.2.2.1 Timber Harvest History	2-19
2.6.2.2.2 Washington State Department of Natural Resources	2-20
2.6.2.2.3 Habitat Conservation Plans (HCPs)	2-21
2.6.2.3 Private Residential and Agricultural Development	2-23
2.6.2.4 Makah Tribe- Ozette Reservation	2-23
2.6.3 Roads	2-23
2.7 LAKE OZETTE SOCKEYE ESU CRITICAL HABITAT	2-24
2.8 LAKE OZETTE SOCKEYE POPULATION STATUS AND ADULT ABUNDANCE TRENDS	2-28
2.8.1 NMFS Status Reviews	2-28
2.8.1.1 Biological Review Team 1997 (Gustafson et al. 1997)	2-28
2.8.1.2 Biological Review Team 1998 (NMFS 1998)	2-29
2.8.1.3 Biological Review Team 2005 (Good et al. 2005)	2-30
2.8.2 Recent Data on Adult Sockeye Population Size and Trends	2-31
2.8.2.1 Historical (Pre-1977) Adult Sockeye Run Sizes	2-31
2.8.2.2 Recent (1977-2003) Adult Sockeye Run Sizes	2-33
2.9 LAKE OZETTE SOCKEYE HATCHERY PRACTICES	2-37
2.9.1 Recent Sockeye Salmon Artificial Propagation Efforts (1984-1999)	2-38
2.9.2 Hatchery and Genetic Management Plan	2-40
3 RECOVERY GOALS, OBJECTIVES, AND CRITERIA	3-1

PROPOSED RECOVERY PLAN FOR LAKE OZETTE SOCKEYE SALMON

3.1	ESA REQUIREMENTS	3-1
3.2	RECOVERY GOALS.....	3-2
3.2.1	Broad-Sense Recovery Goals	3-2
3.2.2	Objectives	3-3
3.2.3	Processes Needed to Accomplish Goals and Objectives	3-3
3.3	OBJECTIVE, MEASURABLE CRITERIA.....	3-4
3.3.1	Biological Viability Criteria	3-4
3.3.2	Adaptive Management	3-7
3.3.3	Listing Factor (Threats) Criteria	3-8
3.4	DELISTING DECISIONS.....	3-13
3.5	MODIFYING OR UPDATING THE RECOVERY PLAN.....	3-14
4	LIMITING FACTORS	4-1
4.1	LIMITING FACTORS APPROACH.....	4-3
4.2	LIMITING FACTORS AFFECTING ALL POPULATION SEGMENTS ..	4-12
4.2.1	Key Limiting Factors	4-13
4.2.1.1	Predation (H#1-Pred).....	4-13
4.2.2	Contributing Limiting Factors	4-15
4.2.2.1	Water Quality (H#2-WQ)	4-15
4.2.2.2	Ozette River Streamflow (H#3-Q).....	4-17
4.2.2.3	Ozette River Habitat Conditions (H#4-Hab)	4-18
4.2.2.4	Marine Survival (H#5-MS).....	4-19
4.2.2.5	Estuary Alterations.....	4-19
4.2.3	Factors Not Likely Limiting Sockeye.....	4-20
4.2.3.1	Ocean Fisheries.....	4-20
4.2.3.2	Freshwater Fisheries	4-21
4.2.3.2.1	Ozette River Fisheries.....	4-21
4.2.3.2.2	Lake Ozette Fisheries.....	4-21
4.2.3.3	Research and Monitoring	4-22
4.2.3.4	Disease	4-22
4.2.3.5	Hatchery Practices	4-22
4.3	LIMITING FACTORS AFFECTING BEACH SPAWNERS	4-24
4.3.1	Key Limiting Factors	4-25
4.3.1.1	Reduced Quantity and Quality of Spawning Habitat (H#6-BSH)	4-25
4.3.1.2	Predation (H#7-Pred).....	4-27
4.3.2	Contributing Limiting Factors	4-28
4.3.2.1	Water Quality (H#8-WQ)	4-29
4.3.2.2	Seasonal Lake Level Changes (H#9-LL).....	4-29
4.3.2.3	Competition (H#10-Comp).....	4-31
4.3.3	Factors Not Likely Limiting Sockeye.....	4-31
4.3.3.1	Research and Monitoring.....	4-31
4.3.3.2	Hatchery Impacts (Genetics).....	4-32
4.3.3.3	Disease	4-32
4.4	LIMITING FACTORS AFFECTING TRIBUTARY SPAWNERS	4-33
4.4.1	Key Limiting Factor.....	4-34
4.4.1.1	Spawning Gravel Quantity and Quality (H#11-TSH)	4-34
4.4.2	Contributing Limiting Factors	4-36

PROPOSED RECOVERY PLAN FOR LAKE OZETTE SOCKEYE SALMON

4.4.2.1	Channel Stability (H#12-Stab).....	4-36
4.4.2.2	Water Quality (H#13-WQ)	4-36
4.4.2.3	Predation (H#14-Pred)	4-38
4.4.2.4	Streamflow (H#15-Q)	4-39
4.4.2.5	Holding Pool Habitats (H#16-HP).....	4-40
4.4.3	Factors Not Likely Limiting Sockeye.....	4-41
4.4.3.1	Competition (Redd Superimposition).....	4-41
4.4.3.2	Interactions with Kokanee	4-42
4.4.3.3	Research and Monitoring.....	4-42
4.4.3.4	DISEASE	4-42
5	RECENT AND ONGOING CONSERVATION EFFORTS	5-1
6	RECOVERY STRATEGY	6-1
6.1	STRUCTURE USED IN RECOVERY GOAL AND STRATEGY DEVELOPMENT	6-2
6.1.1	Landscape Processes and Inputs, Biological Processes, and Habitat Conditions	6-3
6.1.2	Hierarchical Approach to Sockeye Salmon Population Segment Recovery Strategies.....	6-4
6.1.3	Subbasin Prioritization Used in Strategy Development.....	6-7
6.2	GOALS AND STRATEGIES TO RESTORE PROCESSES AND CONDITIONS AFFECTING ALL POPULATION SEGMENTS	6-11
6.2.1	Coastal Processes	6-13
6.2.2	Biological Processes (H#1-Pred)	6-13
6.2.3	Hydrologic Processes (H#3-Q)	6-15
6.2.4	Sediment Processes (H#2-WQ; H#3-Q)	6-16
6.2.5	Thermal Inputs (H#2-WQ; H#3-Q; H#5-MS)	6-18
6.2.6	Riparian-Floodplain Processes.....	6-19
6.2.7	Habitat Conditions (H#4-Hab).....	6-20
6.3	GOALS AND STRATEGIES TO RESTORE PROCESSES AND CONDITIONS AFFECTING BEACH SPAWNERS	6-22
6.3.1	Hydrologic Processes (H#6-BSH; H#9-LL).....	6-24
6.3.2	Sediment Processes (H#6-BSH; H#8-WQ)	6-25
6.3.3	Riparian Processes and Vegetation Colonization (H#6-BSH).....	6-27
6.3.4	Biological Processes (H#7-Pred)	6-28
6.3.5	Habitat Conditions (H#6-BSH).....	6-29
6.4	GOALS AND STRATEGIES TO RESTORE PROCESSES AND CONDITIONS AFFECTING TRIBUTARY SPAWNERS	6-31
6.4.1	Habitat Connectivity	6-33
6.4.2	Hydrologic Processes (H#15-Q)	6-33
6.4.3	Sediment Processes (H#11-TSH;H#13-WQ)	6-35
6.4.4	Riparian and Floodplain Processes (H#11-TSH; H#12-Stab)	6-36
6.4.5	Biological Processes	6-37
6.4.6	Habitat Conditions (H#11-TSH).....	6-38
6.5	SUMMARY OF LAKE OZETTE SOCKEYE RECOVERY STRATEGIES..	6-39
7	RECOVERY PROGRAM ACTIONS	7-1

PROPOSED RECOVERY PLAN FOR LAKE OZETTE SOCKEYE SALMON

7.1	FISHERIES MANAGEMENT ACTIONS	7-6
7.1.1	Tribal Fishing Rights and Lake Ozette Sockeye Salmon Recovery	7-6
7.1.2	Considerations and Criteria for Re-Establishment of Sockeye Salmon Fisheries.....	7-8
7.1.3	Short-Term Actions (Initial 1-12 Years).....	7-9
7.1.3.1	Freshwater Fisheries (RS#4).....	7-9
7.1.3.2	Marine Area Fisheries (RS#4)	7-11
7.1.4	Long-Term Actions (Subsequent 13-50 Years).....	7-11
7.1.4.1	Freshwater Fisheries (RS#4).....	7-11
7.1.4.2	Marine Area Fisheries (RS#4)	7-12
7.2	HABITAT-RELATED ACTIONS	7-12
7.2.1	Habitat-Related Programmatic Actions	7-13
7.2.1.1	Forest Practices HCP	7-13
7.2.1.1.1	Protection Measures Contained in the FPHCP	7-14
7.2.1.1.2	Administrative Framework of the FPHCP.....	7-17
7.2.1.1.3	Additional Actions within the Scope of the FPHCP:.....	7-18
7.2.1.1.4	Proposed Voluntary Actions within the Scope of the FPHCP:....	7-19
7.2.1.2	WDNR State Land HCP	7-19
7.2.1.2.1	Proposed Voluntary Actions within the Scope of the WDNR HCP:	7-20
7.2.1.3	Clallam County Zoning and Land Use	7-21
7.2.1.4	Clallam County Road Maintenance Plan.....	7-21
7.2.1.5	Olympic National Park Management Plan	7-22
7.2.1.6	Olympic Coast National Marine Sanctuary Management Plan	7-22
7.2.1.7	Washington State Department of Fish and Wildlife Hydraulic Code	7-23
7.2.1.8	Washington State Department of Ecology.....	7-24
7.2.2	Habitat Protection and Restoration-Enhancement Projects	7-24
7.2.2.1	Broad-Scale Sediment Reduction Projects	7-24
7.2.2.2	Hydrologic Restoration Projects	7-25
7.2.2.3	Large Woody Debris (LWD) Placement Projects	7-26
7.2.2.3.1	Broad-Scale LWD Placement Projects	7-26
7.2.2.3.2	Site-Specific LWD Placement Projects	7-29
7.2.2.4	Riparian and Floodplain Restoration Projects	7-32
7.2.2.4.1	Broad-Scale Riparian and Floodplain Restoration Actions	7-32
7.2.2.4.2	Site-Specific Riparian and Floodplain Restoration Actions	7-32
7.2.2.5	Spawning Habitat Restoration and Enhancement Projects	7-39
7.2.2.6	Conservation Easements and Land Acquisition	7-39
7.3	HATCHERY SUPPLEMENTATION ACTIONS	7-40
7.3.1	Short-Term Actions	7-40
7.3.1.1	Sockeye Salmon Broodstock Selection and Collection Actions.....	7-42
7.3.1.2	Sockeye Salmon Broodstock Spawning Actions.....	7-42
7.3.1.3	Juvenile Sockeye Salmon Rearing and Release Actions	7-43
7.3.1.4	Hatchery-Origin Adult Sockeye Salmon Disposition Actions	7-44
7.3.1.5	Beach Spawning Aggregation Supplementation Research.....	7-45
7.3.2	Long-Term Actions.....	7-46
7.3.2.1	Potential Long-Term Enhancement Actions.....	7-47

PROPOSED RECOVERY PLAN FOR LAKE OZETTE SOCKEYE SALMON

7.3.2.1.1	Termination or Continuation of Tributary Supplementation Programs.....	7-47
7.3.2.1.2	Natural Colonization of Beaches	7-48
7.3.2.1.3	Mechanical Improvement of Beach Spawning Areas.....	7-49
7.3.2.1.4	Creation of New Beach Spawning Locations and Stock Introduction	7-49
7.3.2.1.5	Supplementation of Beach Spawning Aggregations.....	7-49
7.4	PREDATION-RELATED RECOVERY ACTIONS	7-51
7.5	RESEARCH, MONITORING AND ADAPTIVE MANAGEMENT ACTIONS	7-52
7.6	PUBLIC EDUCATION AND OUTREACH ACTIONS	7-52
7.7	RECOVERY STRATEGY AND ACTION INTEGRATION	7-53
8	ADAPTIVE MANAGEMENT, RESEARCH, MONITORING, AND EVALUATION.....	8-1
8.1	ADAPTIVE MANAGEMENT.....	8-1
8.2	RESEARCH AND MONITORING	8-5
9	IMPLEMENTATION SCHEDULE, RESPONSIBILITIES, AND TIME AND COST ESTIMATES	9-1
9.1	IMPLEMENTATION SCHEDULE AND RESPONSIBILITIES	9-1
9.2	TIME AND COST ESTIMATES	9-5
10	CITATIONS	10-1
	APPENDIX A- List of Steering Committee Member Participants.....	1
	APPENDIX B- Habitat Based Population Recovery Goals	4
	APPENDIX C- Summary of November 17, 2007 Landowner Meeting with NOAA	26
	APPENDIX D- Summary of Programmatic, Site-Specific, and Broad-Scale Actions.	44
	APPENDIX E- Recovery Action Cost Estimates And Schedule	65

FIGURES

Figure 1.1.	NMFS Pacific Northwest Salmon Recovery Domains.	1-5
Figure 2.1.	Lake Ozette watershed overview map.....	2-2
Figure 2.2.	Reported Makah Tribal harvest of Lake Ozette sockeye and other Lake Ozette salmon species from 1948 to 2005. Note: No harvest record data exist for the period prior to 1948. (Source: WDF 1955; Jacobs et al. 1996; Haggerty et al. 2007)	2-9
Figure 2.3.	Known current and historical Lake Ozette sockeye beach spawning locations (modified from Haggerty et al. 2007).	2-10
Figure 2.4.	Conceptual diagram of Lake Ozette sockeye salmon life histories.....	2-11
Figure 2.5.	Conceptualization of Lake Ozette sockeye life history and timing (modified from Jacobs et al. 1996; note migration, tributary spawning, beach spawning, and smolt emigration are scaled to the estimated relative abundance of animals displaying a life history trait through time, whereas holding, incubation, emergence, and rearing are plotted without a scale of relative abundance.).....	2-12
Figure 2.6.	Ozette Watershed landownership and landownership type (data source: Clallam County land parcel database). Note: the WDNR ownership along the Ozette River appears to be an error in the County's records.	2-17

PROPOSED RECOVERY PLAN FOR LAKE OZETTE SOCKEYE SALMON

Figure 2.7. Percentage of old growth forest clear-cut through time for the entire forested portion of the Ozette watershed, as well as the Umbrella Creek, Big River, and Crooked Creek subbasins (source: Haggerty et al. 2007).....	2-20
Figure 2.8. Ozette watershed road lengths and road densities for major subbasins through time (road lengths based on aerial photo coverage; basin areas used in road density calculations were generated using a digital elevation model).	2-24
Figure 2.9. Designated critical habitat for Lake Ozette sockeye salmon. Note: the entire lake is designated critical habitat. (Data from: 70 FR 52630, September 2, 2005)...	2-26
Figure 2.10. Historical abundance of Lake Ozette sockeye (RY1924-1926 and RY1948-1976) based on Kemmerich (1945) and Jacobs et al. (1996).....	2-32
Figure 2.11. Lake Ozette Sockeye run-size estimates for return years 1977-1995, adjusted based on sockeye detection rates and new run-timing curves (from RY 1998-2003) contrasted with estimates reported in Jacobs et al. 1996 (Modified from Haggerty et al. 2007).....	2-35
Figure 2.12. Estimated Lake Ozette sockeye run sizes for return years 1996 to 2003 contrasted with the proportion of the run-size estimates that were based upon expansion and the percentage of run-days in which the weir was deployed (source: Haggerty et al. 2007).....	2-37
Figure 2.13. Total number of sockeye fry or fingerlings and eggs produced from broodstock collected at Lake Ozette beach spawning grounds released into various areas of the Lake Ozette watershed from 1984 through 2000 (BY 1983 to BY 1999; source: MFM, unpublished hatchery release data).	2-40
Figure 4.1. Beach spawning sockeye life history stages and hypothesized limiting factors.....	4-2
Figure 4.2. Tributary spawning sockeye life history stages and hypothesized limiting factors.....	4-2
Figure 4.3. Conceptualization of hypothesized limiting factors affecting all Lake Ozette sockeye population segments. Arrows depict the degree of impact for each limiting factor and colored polygons depict the relative proportion of total mortality by life stage.	4-12
Figure 4.4. Hypothesized limiting factors affecting all population segments, life history phases affected, processes and inputs regulating limiting factors, and activities/conditions affecting processes and inputs.	4-13
Figure 4.5. Conceptualization of hypothesized limiting factors affecting beach spawning Lake Ozette sockeye subpopulations. Arrows depict the degree of impact for each limiting factor and colored polygons depict the relative proportion of total mortality by life stage.	4-24
Figure 4.6. Hypothesized limiting factors affecting only beach spawning subpopulations, life history phases affected, processes and inputs regulating limiting factors, and activities/conditions affecting processes and inputs.	4-25
Figure 4.7. Conceptualization of hypothesized limiting factors affecting tributary spawning Lake Ozette sockeye subpopulations. Arrows depict the degree of impact for each limiting factor and colored polygons depict the relative proportion of total mortality by life stage.	4-33

PROPOSED RECOVERY PLAN FOR LAKE OZETTE SOCKEYE SALMON

Figure 4.8. Hypothesized limiting factors affecting only tributary spawning subpopulations, life history phases affected, processes and inputs regulating limiting factors, and activities/conditions affecting processes and inputs.....	4-34
Figure 6.1. Schematic diagram depicting the relative proportion of sockeye mortality by life stage.....	6-3
Figure 6.2. Schematic depicting the linkage between landscape controls and land use, habitat-forming processes, habitat conditions, and resulting fish population responses (modified from Roni et al. 2005).....	6-4
Figure 6.3. Flow chart depicting hierarchical strategy for prioritizing protection, restoration, and enhancement activities. (Note: red rectangles represent impaired processes or conditions, yellow ovals represent the need to develop strategies and implement actions, green rectangles represent restored processes where planners can then move down through the flow chart).....	6-5
Figure 6.4. Ozette sockeye-specific recovery strategy and action hierarchy.....	6-6
Figure 6.5. Schematic diagram depicting system used for prioritizing Lake Ozette subbasins.	6-8
Figure 6.6. Lake Ozette subbasin prioritization. Green lines depict priority I subbasins, yellow lines depict priority II subbasins, and black lines entering Lake Ozette and the Ozette river depict priority III subbasins.	6-10
Figure 6.7. Schematic diagram depicting the linkages between watershed controls, watershed-scale processes and inputs, limiting factors hypotheses, and activities that alter processes and inputs.....	6-11
Figure 6.8. Flow chart depicting hierarchical strategy for prioritizing protection, restoration, and enhancement activities for factors affecting all population segments (adapted from Roni et al. 2002).	6-12
Figure 6.9. Schematic diagram depicting the linkage between watershed controls, watershed scale processes and inputs, limiting factors hypotheses, and activities that alter processes and inputs for beach spawning sockeye.	6-22
Figure 6.10. Flow chart depicting hierarchical strategy for prioritizing protection, restoration, and enhancement activities for factors affecting beach spawners (adapted from Roni et al. 2002).	6-23
Figure 6.11. Schematic diagram depicting the linkage between watershed controls, watershed scale processes and inputs, limiting factors hypotheses, and activities that alter processes and inputs for tributary spawning sockeye.....	6-31
Figure 6.12. Flow chart depicting hierarchical strategy for prioritizing protection, restoration, and enhancement activities for factors affecting tributary spawners (adapted from Roni et al. 2002).	6-32
Figure 7.1. Overview of LWD conditions measured in 1999 and 2000 in major tributaries to Lake Ozette (source: Haggerty and Ritchie 2004).	7-30
Figure 7.2. LWD conditions measured in 1999 and 2000 in Umbrella Creek, thick red lines depict sites where LWD reintroduction should be considered (source: Haggerty and Ritchie 2004).	7-31
Figure 7.3. Riparian treatment areas adjacent to upper Ozette River.	7-33
Figure 7.4. Map depicting Big River channel segments, roads, riprap, and residences within 200 feet of bankfull edge and the conceptual location of Hoko-Ozette Road realignment.	7-34

PROPOSED RECOVERY PLAN FOR LAKE OZETTE SOCKEYE SALMON

Figure 7.5. Map depicting Big River habitat segments 3f and 3g with pastures, roads, riprap, and residences within 200 feet of the bankfull edge.	7-35
Figure 7.6. Map depicting Big River habitat segments 3h through 3j with pastures, roads, riprap, and residences within 200 feet of the bankfull edge.	7-36
Figure 7.7. Map depicting Big River habitat segments 3k, 3l, 4a, 4b, and 4c with pastures, roads, riprap, and residences within 200 feet of the bankfull edge.	7-37
Figure 7.8. Big River habitat segments and 2006 mapped knotweed locations (knotweed source data provided by Makah Forestry).	7-38
Figure 8.1. NMFS listing status decision framework.	8-4
Figure 9.1. Relationship of potential implementing entities and functions from December 14, 2007 steering committee meeting.	9-4

TABLES

Table 2.1. Lake Ozette and tributary drainage basin areas.	2-4
Table 2.2. Estimated Lake Ozette sockeye run sizes, monitoring periods, and methods used. For details on methods used see Lake Ozette Sockeye LFA (Source: Haggerty et al. 2007).	2-34
Table 2.3. Estimated adult sockeye run sizes entering Lake Ozette for return years 1996 through 2003 (Source: Haggerty et al. 2007).	2-36
Table 2.4. Total number of fingerlings or fry and eggs produced from broodstock collected at Lake Ozette sockeye spawning beaches, released at various locations in the watershed from 1984 through 2000 (modified from MFM 2000).	2-39
Table 2.5. Summary of HGMP sockeye fry and fingerling releases in the Ozette watershed for brood years 2000 through 2003 (source: MFM, unpublished hatchery release data).	2-43
Table 3.1. Summary of proposed Lake Ozette sockeye viability criteria for naturally self-sustaining adults (Source: Rawson et al. 2008)	3-8
Table 4.1. Summary of limiting factors hypotheses presented and links to limiting factors hypotheses presented in the LFA (Haggerty et al. 2007).	4-6
Table 6.1. Responses to subbasin prioritization questions and subsequent subbasin priority ratings.	6-9
Table 6.2. Summary of coastal process condition, linkage to limiting factors hypotheses, and activities affecting coastal processes.	6-13
Table 6.3 Summary of biological process condition, linkage to limiting factors hypotheses, and activities affecting biological processes.	6-14
Table 6.4 Summary of hydrologic process condition, linkage to limiting factors hypotheses, and activities affecting hydrologic processes.	6-15
Table 6.5 Summary of sediment process condition, linkage to limiting factors hypotheses, and activities affecting sediment processes.	6-17
Table 6.6. Summary of thermal input process condition, linkage to limiting factors hypotheses, and activities affecting thermal inputs.	6-19
Table 6.7 Summary of sediment process condition, linkage to limiting factors hypotheses, and activities affecting sediment processes.	6-20
Table 6.8 Summary of habitat conditions, linkage to limiting factors hypotheses, and activities affecting habitat conditions.	6-21

PROPOSED RECOVERY PLAN FOR LAKE OZETTE SOCKEYE SALMON

Table 6.9 Summary of hydrologic process condition, linkage to limiting factors hypotheses, and activities affecting hydrologic processes.....	6-24
Table 6.10 Summary of sediment process condition, linkage to limiting factors hypotheses, and activities affecting sediment processes.....	6-26
Table 6.11 Summary of riparian processes condition, linkage to limiting factors hypotheses, and activities affecting riparian processes.....	6-27
Table 6.12. Summary of biologic process condition, linkage to limiting factors hypotheses, and activities affecting biological processes.	6-29
Table 6.13 Summary of habitat conditions, linkage to limiting factors hypotheses, and activities affecting habitat conditions.	6-30
Table 6.14 Summary of habitat connectivity condition, linkage to limiting factors hypotheses, and activities affecting habitat connectivity.....	6-33
Table 6.15. Summary of hydrologic process condition, linkage to limiting factors hypotheses, and activities affecting hydrologic processes.....	6-34
Table 6.16 Summary of sediment process condition, linkage to limiting factors hypotheses, and activities affecting sediment processes.....	6-35
Table 6.17 Summary of riparian and floodplain processes condition, linkage to limiting factors hypotheses, and activities affecting riparian and floodplain processes.	6-36
Table 6.18 Summary of hydrologic process condition, linkage to limiting factors hypotheses, and activities affecting hydrologic processes.....	6-38
Table 6.19 Summary of habitat conditions, linkage to limiting factors hypotheses, and activities affecting habitat conditions.	6-39
Table 6.20. Summary of Lake Ozette sockeye salmon recovery strategies.....	6-40
Table 7.1. Summary of proposed recovery program actions.	7-2
Table 8.1. Research, monitoring, and evaluation needs for long-term decisionmaking (not prioritized)	8-5

ACRONYMS/ABBREVIATIONS USED

BFD	bankfull depth
BFW	bankfull width
BIA	Bureau of Indian Affairs
BRT	West Coast Biological Review Team
BY	brood year
cfs	cubic feet per second
cfs/mi²	cubic feet per second per square mile
CMER	Cooperative Monitoring, Evaluation and Research Committee, established by Washington State Forest Practices Board
CMZ	channel migration zone
CW	channel width
DBH	diameter at breast height
DNR	Washington State Department of Natural Resources
DOE	Washington State Department of Ecology
EPA	Environmental Protection Agency
ESA	Endangered Species Act

PROPOSED RECOVERY PLAN FOR LAKE OZETTE SOCKEYE SALMON

ESU	evolutionarily significant unit
FL	fork length
FPHCP	Forest Practices Habitat Conservation Plan
GLO	Government Land Office
HCP	Habitat Conservation Plan
HGMP	Hatchery and Genetic Management Plan
HORs	hatchery-origin recruits
JRMP	Joint Resource Management Plan
LB	left bank
LFA	Lake Ozette Sockeye Limiting Factors Analysis (Haggerty et al. 2007)
LWD	large woody debris
MDN	marine-derived nutrients
MFM	Makah Fisheries Management
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NORs	natural-origin recruits
NWIFC	Northwest Indian Fisheries Commission
ONF	Olympic National Forest
ONP	Olympic National Park
PFMC	Pacific Fishery Management Council
PSTRT	Puget Sound Technical Recovery Team
RB	right bank
RBT	right bank tributary
RM	river mile
RMP	Resource Management Plan
RY	return year
SASSI	Salmon and Steelhead Stock Inventory
SEPA	State Environmental Policy Act
SL	standard length
SS	suspended sediments
SSC	suspended sediment concentration
SSHIAP	Salmon Steelhead Habitat Inventory and Assessment Project
TFW	Timber, Fish, and Wildlife
TL	total length
TRT	Technical Recovery Team
USCG	United States Coast Guard
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VSP	viable salmonid population
WAU	Watershed Administrative Unit
WDF	Washington Department of Fisheries
WDFW	Washington State Department of Fish and Wildlife
WFPB	Washington State Forest Practice Board
WRIA	Water Resource Inventory Area

GLOSSARY

This glossary is provided to help new readers differentiate between a number of terms related to types of plans, goals, and spatial scales relevant to recovery planning for salmon and steelhead in the Lake Ozette Basin.

Adaptive management: The process of adjusting management actions and/or directions as new and better information emerges about the ecosystem.

Anadromous fish: Species that are hatched in freshwater, migrate to and mature in salt water, and return to freshwater to spawn.

Baseline monitoring: In the context of recovery planning, baseline monitoring is done before implementation, in order to establish historical and/or current conditions against which progress (or lack of progress) can be measured.

Broad-sense recovery goals: Goals defined in the recovery planning process, generally by local recovery planning groups, that go beyond the requirements for delisting, to address, for example, other legislative mandates or social, economic, and ecological values.

Compliance monitoring: Monitoring to determine whether a specific performance standard, environmental standard, regulation, or law is met.

Delisting criteria: Criteria incorporated into ESA recovery plans that define both biological viability (biological criteria) and alleviation of the causes for decline (threats criteria, based on the five listing factors in ESA section 4[a][1]), and that, when met, would result in a determination that a species is no longer threatened or endangered and can be proposed for removal from the Federal list of threatened and endangered species.

Diversity: All the genetic and phenotypic (life history, behavioral, and morphological) variation within a population. Variations could include anadromy vs. lifelong residence in freshwater, fecundity, run timing, spawn timing, juvenile behavior, age at smolting, age at maturity, egg size, developmental rate, ocean distribution patterns, male and female spawning behavior, physiology, molecular genetic characteristics, etc.

Effectiveness monitoring: Monitoring set up to test cause-and-effect hypotheses about recovery actions: Did the management actions achieve their direct effect or goal? For example, did fencing a riparian area to exclude livestock result in recovery of riparian vegetation?

ESA recovery plan: A plan to recover a species listed as threatened or endangered under the U.S. Endangered Species Act (ESA). The ESA requires that recovery plans, to the extent practicable, incorporate (1) objective, measurable criteria that, when met, would result in a determination that the species is no longer threatened or endangered; (2) site-

PROPOSED RECOVERY PLAN FOR LAKE OZETTE SOCKEYE SALMON

specific management actions that may be necessary to achieve the plan's goals; and (3) estimates of the time required and costs to implement recovery actions.

Evolutionarily significant unit (ESU): A group of Pacific salmon or steelhead trout that is (1) substantially reproductively isolated from other conspecific units and (2) represents an important component of the evolutionary legacy of the species. All Pacific salmon belong to the family *Salmonidae* and the genus *Oncorhynchus*, while sockeye belong to the species *Oncorhynchus nerka*. Lake Ozette sockeye are an “evolutionarily significant unit” of *O. nerka*.

Factors for decline: Five general categories of causes for decline of a species, listed in the Endangered Species Act section 4(a)(1)(b): (A) the present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence.

Hyporheic zone: Area of saturated sediment and gravel beneath and beside streams and rivers where groundwater and surface water mix.

Implementation monitoring: Monitoring to determine whether an activity was performed and/or completed as planned.

Independent population: Any collection of one or more local breeding units whose population dynamics or extinction risk over a 100-year time period is not substantially altered by exchanges of individuals with other populations.

Indicator: A variable used to forecast the value or change in the value of another variable.

Large woody debris (LWD): A general term for wood naturally occurring or artificially placed in streams, including branches, stumps, logs that meet minimum diameter criteria that vary by biogeographical region, and logjams. Streams with adequate LWD tend to have more pools and greater habitat complexity, and store greater amounts of sediment.

Legacy effects: Impacts from past activities (usually a past land use action) that continue to affect a stream or watershed in the present day.

Limiting factor: Physical, biological, or chemical features (e.g., inadequate spawning habitat, high water temperature, insufficient prey resources) experienced by the fish at the population, intermediate (e.g., stratum or major population grouping), or ESU levels that result in reductions in viable salmonid population (VSP) parameters (abundance, productivity, spatial structure, and diversity). Key limiting factors are those with the greatest impacts on a population’s ability to reach its desired status.

PROPOSED RECOVERY PLAN FOR LAKE OZETTE SOCKEYE SALMON

Morphology: The form and structure of an organism, with special emphasis on external features.

Parr: The stage in anadromous salmonid development between absorption of the yolk sac and transformation to smolt before migration seaward.

Phenotype: The external appearance of an organism resulting from the interaction of its genetic makeup and the environment.

Piscivorous: (Adj.) Fish that prey on other fish for food.

Productivity: For Pacific salmon and steelhead, this is a measure of a population's ability to sustain itself or its ability to rebound from low numbers. The terms "population growth rate" and "population productivity" are interchangeable when referring to measures of population production over an entire life cycle. Can be expressed as the number of recruits (adults) per spawner or the number of smolts per spawner.

Recovery domain: An administrative unit for recovery planning defined by NMFS based on ESU boundaries, ecosystem boundaries, and existing local planning processes. Recovery domains may contain one or more listed ESUs.

Recovery goals: Goals incorporated into a recovery plan, which may include recovery, delisting, reclassification, and/or other goals. Broad-sense goals are a subset of recovery goals.

Recovery strategy: According to NMFS Recovery Planning Guidance (July 2006), a recovery strategy is a statement that identifies the assumptions and logic – the rationale – for the species' recovery program. The term is also used as a broad statement of types of actions or objectives that are further broken down into more specific actions or projects.

Redd: A nest constructed by female salmonids in streambed gravels where eggs are deposited and fertilization occurs.

Riparian area: Area with distinctive soils and vegetation between a stream or other body of water and the adjacent upland. It includes wetlands and those portions of floodplains and valley bottoms that support riparian vegetation.

Salmonid: Fish of the family *Salmonidae*, including salmon, trout, chars, grayling, and whitefish. In general usage, the term usually refers to salmon, trout, and chars.

Smolt: A juvenile salmonid in the seaward migration stage, undergoing physiological and behavioral changes to adapt from freshwater to saltwater.

Spatial structure: Geographic distribution of a population or populations in an ESU.

PROPOSED RECOVERY PLAN FOR LAKE OZETTE SOCKEYE SALMON

Stakeholders: Agencies, groups, or private citizens with an interest in recovery planning, or who will be affected by recovery planning and actions.

Technical Recovery Team (TRT): Teams convened by NMFS to develop technical products related to recovery planning. TRTs are complemented by planning forums unique to specific states, tribes, or regions, which use TRT and other technical products to identify recovery actions.

Threats: Human activities or natural events (e.g., road building, floodplain development, fish harvest, hatchery influences, volcanoes) that cause or contribute to limiting factors. Threats may exist in the present or be likely to occur in the future.

Viability criteria: Criteria defined by NMFS-appointed Technical Recovery Teams based on the biological parameters of abundance, productivity, spatial structure, and diversity, which describe a viable salmonid population (VSP) (an independent population with a negligible risk of extinction over a 100-year time frame) and which describe a general framework for how many and which populations within an ESU should be at a particular status for the ESU to have an acceptably low risk of extinction. These criteria are used as technical input into the recovery planning process and provide a technical foundation for development of biological delisting criteria.

Viable salmonid population (VSP): an independent population of Pacific salmon or steelhead trout that has a negligible risk of extinction over a 100-year time frame. Viability at the independent population scale is evaluated based on the parameters of abundance, productivity, spatial structure, and diversity.

VSP parameters: Abundance, productivity, spatial structure, and diversity. These describe characteristics of salmonid populations that are useful in evaluating population viability. See NOAA Tech. Memo. NMFS-NWFSC-42, "Viable salmonid populations and the recovery of evolutionarily significant units," McElhany et al. June 2000.